What is claimed is:

1. A hydrogel composition for use in transdermal extraction of an analyte, said hydrogel composition comprising:

a hydrophilic compound capable of forming a gel in the presence of water, an electrolyte, a phosphate buffer present at a concentration of between about 125 mM and about 500mM, and a pH of between about pH 6.5 to about pH 8.5.

2. The hydrogel of claim 1, wherein the hydrophilic compound is selected from the group consisting of polyethylene oxide, polyvinyl alcohol, polyacrylic acid, and polyvinyl pyrrolidone, and co-polymers thereof.

3. The hydrogel composition of claim 1, wherein said hydrophilic compound comprises polyethylene oxide.

4. The hydrogel composition of claim 1, wherein said hydrophilic compound is a polymer, and said polymer is present at a weight percent of between about 0.5% to about 40%.

5. The hydrogel composition of claim 1, wherein said pH is between about pH 7 to about pH 8.

6. The hydrogel composition of claim 1, wherein the hydrogel further comprises a cross-linking agent.

7. The hydrogel composition of claim 6, wherein said cross-linking agent is present at a weight percent of from about 0.001% to about 2%.

8. The hydrogel composition of claim 7, wherein said cross-linking agent is N,N'-methylenebisacrylamide.

9. The hydrogel composition of claim 1, wherein said hydrogel is treated with e-beam radiation to promote cross-linking within the hydrogel.

10. The hydrogel composition of claim 1, wherein said phosphate buffer comprises monobasic and dibasic phosphate.

11. The hydrogel composition of claim 10, wherein said monobasic and dibasic phosphate comprise counter ions and said counter ions are selected from the group consisting of sodium counter ions, potassium counter ions, and mixtures thereof.

12. The hydrogel composition of claim 11, wherein for said monobasic and dibasic phosphate the counter ion is potassium.

13. The hydrogel composition of claim 1, wherein said electrolyte is a chloride salt.

14. The hydrogel composition of claim 13, wherein said chloride salt is present at a weight percent of between about 0.25% to about 2%.

15. The hydrogel composition of claim 13, wherein said chloride salt is selected from the group consisting of sodium chloride, potassium chloride, and mixtures thereof.

16. The hydrogel composition of claim 15, wherein said chloride salt is potassium chloride.

17. The hydrogel composition of claim 1, wherein said hydrogel further comprises an enzyme.

18. The hydrogel composition of claim 17, wherein said analyte is glucose and said enzyme comprises glucose oxidase.

19. The hydrogel composition of claim 1, wherein the hydrogel further comprises a biocide.

20. The hydrogel composition of claim 19, wherein said biocide is selected from the group consisting of chlorinated hydrocarbons, organometallics, metallic salts, organic sulfur compounds, phenolic compounds, quaternary ammonium compounds, surfactants, membrane-disrupting agents, and combinations thereof.

21. The hydrogel composition of claim 19, wherein said biocide is undecylenic acid or a salt thereof.

22. A collection assembly/electrode assembly comprising,

a first hydrogel having first and second surfaces, said hydrogel comprising a hydrophilic compound capable of forming a gel in the presence of water, an electrolyte, a phosphate buffer present at a concentration of between about 125 mM and about 500mM, and a pH of between about pH 6.5 to about pH 8.5, and

a first sensing electrode, wherein said first sensing electrode (i) is aligned to contact said second surface of said first hydrogel, and (ii) has a reactive surface comprising a platinum group metal and a polymer binder.

23. The collection assembly/electrode assembly of claim 22, further comprising a first iontophoretic electrode, wherein said first iontophoretic electrode is aligned to contact said second surface of said first hydrogel.

24. The collection assembly/electrode assembly of claim 23, further comprising,

a second hydrogel having first and second surfaces, and

a second sensing electrode, wherein said second sensing electrode (i) is aligned to contact said second surface of said first hydrogel, and (ii) has a reactive surface comprising a platinum group metal and a polymer binder.

25. The collection assembly/electrode assembly of claim 24, wherein said second hydrogel comprises a hydrophilic compound capable of forming a gel in the presence of water, an electrolyte, a phosphate buffer present at a concentration of between about 125 mM and about 500mM, and a pH of between about pH 6.5 to about pH 8.5.

26. The collection assembly/electrode assembly of claim 25, further comprising a second iontophoretic electrode, wherein said second iontophoretic electrode is aligned to contact said second surface of said second hydrogel.

27. A method of increasing transdermal flux of an analyte, said method comprising:

extracting the analyte across a tissue surface using an iontophoretic sampling device, said sampling device comprising a hydrogel composition of claim 1, wherein said increase in transdermal flux is evaluated relative to extracting the analyte using said iontophoretic sampling device wherein said hydrogel composition instead comprises a hydrophilic compound capable of forming a gel in the presence of water, an electrolyte, a phosphate buffer present at a concentration of equal to or less than 100 mM, and a pH of about pH 7 to about pH 8.

28. The method of claim 27, wherein the tissue surface is the stratum corneum of skin tissue or a mucosal surface.

29. A method of determining the concentration of an analyte in a mammalian subject using a monitoring system comprising an iontophoretic sampling device, said method comprising:

providing a current to first and second iontophoretic electrodes of the sampling device in an amount sufficient to effect the extraction of said analyte through the mammalian subject's skin, into a hydrogel of claim 1, and to a catalytic surface of a first sensing electrode, wherein (i) a first surface of said hydrogel is in contact with a tissue surface of the

mammalian subject, and (ii) a second surface of said hydrogel is in contact with the first iontophoretic electrode and the first sensing electrode;

providing a potential to the first sensing electrode in an amount sufficient to drive electrochemical detection of said analyte or an analyte-related chemical signal;

measuring electrical current generated by the electrochemical detection at the electrode; and

correlating the measured current to a concentration or amount of analyte in the mammalian subject.

30. The method of claim 29, wherein the tissue surface is the stratum corneum of skin tissue or a mucosal surface.

31. The method of claim 29, wherein the hydrogel comprises glucose oxidase, the analyte is glucose, and the analyte related chemical signal is hydrogen peroxide.

32. The method of claim 29, wherein said monitoring system further comprises a second hydrogel of claim 1, wherein (i) a first surface of said second hydrogel is in contact with the tissue surface of the mammalian subject, and (ii) a second surface of said second hydrogel is in contact with the second iontophoretic electrode and a second sensing electrode.